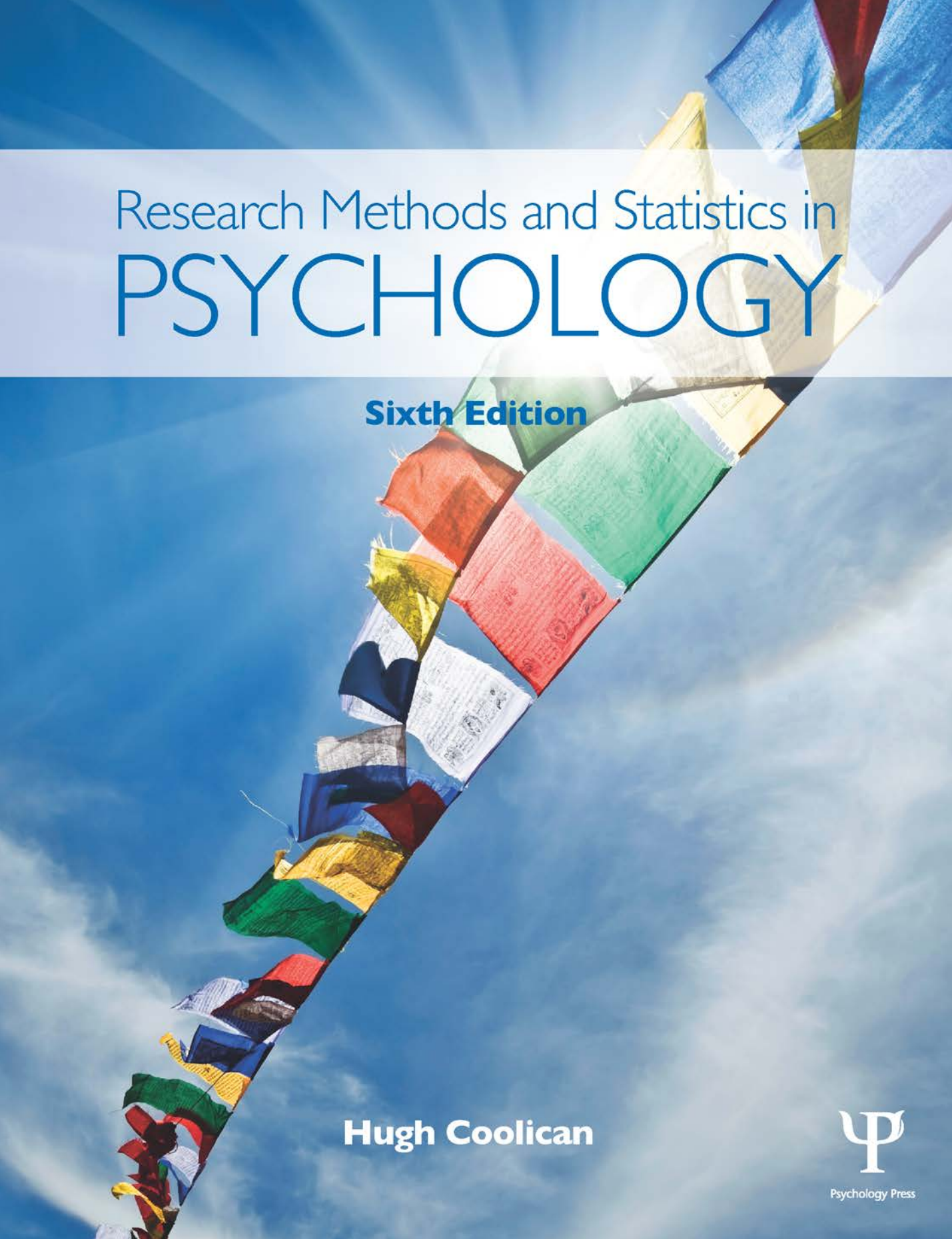
Research Methods and Statistics in PSYCHOLOGY

Sixth Edition



Hugh Coolican

Psychology Press

Research Methods and Statistics in Psychology

This sixth edition of *Research Methods and Statistics in Psychology* has been fully revised and updated, providing students with the most readable and comprehensive survey of research methods, statistical concepts and procedures in psychology today. Assuming no prior knowledge, this bestselling text takes you through every stage of your research project, giving advice on planning and conducting studies, analysing data and writing up reports.

The book provides clear coverage of statistical procedures, and includes everything from nominal level tests to multi-factorial ANOVA designs, multiple regression and log linear analysis. It features detailed and illustrated SPSS instructions for all these procedures, eliminating the need for an extra SPSS textbook.

New features in the sixth edition include:

- 'Tricky bits' – in-depth notes on the things that students typically have problems with, including common misunderstandings and likely mistakes.
- Improved coverage of qualitative methods and analysis, plus updates to Grounded Theory, Interpretive Phenomenological Analysis and Discourse Analysis.
- A full and recently published journal article using Thematic Analysis, illustrating how articles appear in print.
- Discussion of contemporary issues and debates, including recent coverage of journals' reluctance to publish replication of studies.
- Fully updated online links, offering even more information and useful resources, especially for statistics.

Each chapter contains a glossary, key terms and newly integrated exercises, ensuring that key concepts are understood. A companion website provides additional exercises, revision flash cards, links to further reading and data for use with SPSS.

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To Rama Kiran and Jeevan

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Preface

This book is for anyone starting out on a psychology course that contains a fair amount of hands-on practical research training and the writing up of psychological reports. It will be most useful for those studying for a psychology degree but will also serve students on Masters courses in psychology (where methods knowledge may have become a little rusty), on other social sciences courses, on nursing degrees and in several other related disciplines. It should also be useful for A Level and IB students but especially for their tutors who may need to sort out methods concepts and statistical knowledge.

The common factor is the need to understand how researchers gather data in a fair and unbiased manner and how they analyse and interpret those data. A feature that I'm sure all such readers would be pleased to find is a friendly common-sense approach that uses concrete examples to explain otherwise abstract and sometimes complex notions. In the past this book has been praised for doing just that and I truly hope it continues to do so.

A basic premise of the book has always been that people start out on research methods courses with many of the basic principles already acquired through their experience of everyday life. To some extent the job of tutors and writers is to harness those concepts and to formalise and then elaborate upon them. Before you do psychology you probably know just what a fair experiment would be, what an average is, what it means when people deviate a lot from an average and even the fundamentals of *statistical significance* – you can probably tell intuitively when samples of girls' and boys' reading scores differ by an amount that cannot be explained just by chance variation. Hence you are not really starting out on something you know little about no matter how wary you may be of numbers and science.

One of the bonuses of studying research methods and statistics is that you greatly enhance what Neil Postman (1971) referred to as your personal 'crap detection' system, to put it rather crudely. That is, a study of methods and statistics, at the very least and done properly, will enhance your ability to spot gross errors in the statistical arguments of advertisers, politicians and charlatans who try to use numbers or 'findings' to bamboozle you. There are several examples of such poor methods or data massaging in the book and hopefully you will later be able to argue 'Ah but, . . .' at dinner parties and become everybody's best friend as you point out the flaws in the assumptions people make from 'findings' that have made the news.

Many people start psychology courses with a very strong fear of the statistics that may be involved. This is understandable if, for you, the world of numbers has always been something of a no-go area. However, statistics is one of the easiest areas of maths (it must be, both my children said so, even the one for whom maths was a nightmare). You should not have to do a lot of by-hand calculating unless your tutors are sadists! Psychological research is not about learning to do sums; it's about using statistical tools to summarise data and to show people that we have found a relationship between the data that supports a particular view or theory about how people work. Where you do have to calculate, be assured that the actual calculation steps for most procedures

never extend beyond the basic capability of the average 11 year old, and can all be done on a £2 calculator.

In this sixth edition there have been several changes. First, a new feature is the introduction of 'Tricky bits' boxes at the end of most chapters. I thought I would put in here some notes on things that students typically and predictably have problems with – common misunderstandings, likely mistakes in handling data and, basically, tricky bits. Second, instructions for SPSS now cover the latest edition (v.20) as well as the last few previous versions in most respects. V.20 was one of SPSS's major upgrades so instructions on this version should be valid for quite a few years. Third, qualitative methods have been thoroughly upgraded.

Qualitative methods are integrated into general chapters (e.g., interviewing, observation and the quantitative–qualitative debate in Chapter 2) and two specialist chapters. The first edition was almost certainly the first general methods text in the UK to pay specific attention to qualitative methods. The two focused qualitative methods chapters have been drawn closer together and there is now far more specific advice on how to analyse data using thematic analysis, along with similar advice for grounded theory, interpretive phenomenological analysis and discourses analysis. A full qualitative article has been included which uses thematic analysis. For qualitative methods in particular, but also in general, there are, in this edition, far more website addresses to consult for further information and resources.

Contemporary issues covered this time include the role of peer review and the emerging controversy concerning prestigious journals' reluctance to accept articles that replicate previous studies. There are also several attempts to tackle 'psychology myths' such as what the Hawthorne studies really showed, how Zimbardo biased participants in his famous study and, more substantially, a debate on the much misused term 'ecological validity', which is extended on the companion website: www.psypress.com/cw/coolican. This companion website was a major new technology addition with the fifth edition and I hope it will expand to include several more extended debates and other detailed information that could not have appeared in the book itself for reasons of size.

I encourage feedback, queries and, yes, people just telling me I'm wrong about something – how else would we learn? You can e-mail me your queries and I will attempt to provide a clear response. Finally I'd like to repeat something from the fourth edition preface. While you toil away, writing those inevitable research reports, just keep thinking that none of the truly fascinating ideas about human behaviour and experience and none of the wonderful insights about ourselves that can be gained on a short psychology course would be possible without someone (many committed people in fact) doing exactly as you are doing – researching and writing reports. This is where psychology comes from. Doing methods is not meant to be a punishment or something to make the subject 'hard'. Without research, psychology just wouldn't exist!

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Part I

Research methods and ethics

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Psychology, science and research

This introduction sets the scene for research in psychology. The key ideas are:

- Psychological researchers generally follow a *scientific approach,* developed from the 'empirical method' into the 'hypothetico-deductive method'. This involves careful definition and measurement, and the logic of testing hypotheses produced from falsifiable theories.
- Most people use the rudimentary logic of scientific theory testing quite often in their everyday lives.
- Although scientific thinking is a careful extension of common-sense thinking, common sense on its own can lead to false assumptions.
- Claims about the world *must* always be supported by *evidence.*
- Good research is *replicable*; theories are clearly explained and *falsifiable*.
- Theories in science and in psychology are not 'proven' true but are *supported* or *challenged* by research evidence. Much research attempts to *eliminate* variables as possible explanations. It also attempts to broaden the scope of a previously demonstrated effect or to find instances where the effect does not occur.
- Scientific research is a continuous and social activity, involving promotion and checking of ideas among colleagues.
- Research has to be planned carefully, with attention to *design*, *variables*, *samples* and subsequent *data analysis*. If all these areas are not thoroughly planned, results may be ambiguous or useless.
- Some researchers have strong objections to the use of traditional *quantitative* scientific methods in the study of persons. They support *qualitative methods* and data gathering, dealing with meaningful verbal data rather than exact measurement and statistical summary.

Why psychology and science?

If you are just starting to read this book, then you have probably started on a course in psychology and may have been surprised, if not daunted, to find your tutors talking about psychology being a 'science'. You will probably have found that you must carry out practical research exercises, make measurements, deal with statistics and write up your findings as a scientific report (or, just maybe,

you weren't surprised at all). Many people cannot divorce from their concept of 'science' images of Bunsen burners, retort stands, white coats, complicated mathematical formulae and really unpleasant smells.

Rest assured the psychological 'laboratory' contains none of these things and shouldn't really involve you in difficult maths. There is the use of statistics for sure but (a little later on) I hope to assure you that all statistical calculations can be carried out on a £2 calculator and, anyway, there are computers to do any serious number crunching.

The main point to put across right here and now, however, is that science is *not* about retort stands and white coats. It is a *system of thought* that leads us to a rational explanation of how things work in the world and a process of getting closer to truths and further from myths, fables and unquestioned or 'intuitive' ideas about people. A further point, and one which is central to the approach of this book, is to emphasise that you already do think scientifically even if you thought you didn't (or not very often). We will return to that point too in a moment.

This book, then, is about the ways that psychologists go about establishing evidence for their theories about people. It's about how they do research and the advantages and disadvantages involved in the use of alternative methods. In this chapter, we will discuss the reasons why psychology uses the scientific method and ask, what *is* science and what is scientific thinking? We will also briefly introduce a vein within psychological research that largely rejects traditional scientific methods, especially the attempt to measure or predict behaviour.

Isn't a lot of psychology just simple intuition?

But first let's address those readers who are disappointed because they thought that, after all, psychology is not a physical science and we all know so much about people already; surely a lot of it is plain common sense or pure intuition? Intuition is often seen as a handy short cut to truth.

Well let's look at something that will be intuitively obvious to most people. Ever since the arrival of text messaging, parents and teachers have knowledgeably complained that what they see as the ugly use of text abbreviations or *textisms* ('gr8', 'ur' and so on) will have an inevitably detrimental effect on the user's standard of English. The media overwhelmingly assume a negative effect of texting on standard English (Thurlow, 2006). Indeed my own university psychology department banned the use of text language in e-mails in the interests of maintaining English standards. So we 'know' that text language is bad for young people's English . . . or do we?

Plester, Wood and Bell (2008) did not rely on this kind of intuitive knowledge and instead conducted *empirical research* – a term to be explained in a short while but meaning that they looked for *evidence* – valid facts about text messaging. They found, contrary to popular opinion on the matter, that children aged 11–12 who used more textisms produced *better* scores on a test of verbal reasoning ability – a measure that is strongly related to Key Stage 2 and 3 English scores. In addition the researchers found that the better these children were at translating text messages the better they were at spelling. There was also a similar and strong relationship between writing ability and the use of textisms. A lot of psychological studies do in fact tend to corroborate what

we already might have believed but I really like studies such as this one where what was 'obvious' turns out to be quite wrong. Results like these teach us to always *check the evidence* and not to just trust our intuitive guesses (that *feel* like fact).

Why can't we trust intuition?

We can't trust intuition because it depends too much on myth, stereotype, prejudice and received but unchecked wisdom. In addition, when confronted with a new problem intuition is very vulnerable to our tendency to stick with what we know. Try these two problems and don't read any further until you have had a think about them.

Pause for thought

Imagine a rope placed around the circumference of the Earth (and please try to ignore hills, mountains and lakes). Suppose we now want to lift the rope so that it is 1 metre above the Earth all the way around. About how much more rope would we need?

Take a piece of paper and fold it over on itself three times. The paper is now a bit thicker than it was before. We can't physically fold a piece of paper more than about seven times so just imagine folding it over on itself another 50 times. How thick would the paper now be?

The answer to the first problem is just over 6 metres! How can that be you say because the Earth is so huge. The trouble here is that because part of the problem involves a massive size, we think the answer must be massive . . . but it isn't. If you'd like to check out the calculation then take a look at p. 30; having promised no awkward maths, it would be unwise of me to put formulae into the main text right now!

Exactly the same process happens with the second problem but in the opposite direction. Here we know paper is very thin so we assume the answer will be a relatively small amount. In fact the paper would be thick enough to stretch from the Earth to the Sun . . . and back again . . . and back again with a bit left over! I haven't provided a calculation for this but if you take a piece of paper to be 0.1 mm. thick[1], then double this thickness 53 times (using Excel, for instance), you'll get a huge number of millimetres which you can then divide by 1,000,000 to get kilometres. If you now convert to UK measurement the distance is about 280 million miles!

What has all this to do with psychology? Well, the problem we're dealing with here is that intuition, or 'common sense', gives us 'obvious' answers which are incorrect so we can't rely on it for developing a system of psychological knowledge.

1 Please note that this book uses the British Psychological Society Style Guide recommendation of using a leading zero where a value *could* be greater than one, but not where the highest value possible is one (e.g., $p = .05$).

Intuition is an even poorer help when issues are much more personal to us. Ritov and Baron (1990) asked participants a hypothetical question. 'Imagine there is a flu epidemic during which your child has a 10 in 10,000 chance of dying. There is a vaccine which will certainly prevent the disease but it can produce fatalities.' They asked participants to decide the maximum level of risk of death from the vaccine that they would accept for their child. Participants generally would not accept a risk higher than 5 in 10,000. In other words, participants were willing to submit their child to a 1 in 1,000 chance of dying from flu rather than take the lower (1 in 2,000) risk of death from the vaccine. This is 'magical thinking'. Perhaps people thought that they would rather 'chance' their child than that any positive decision they made could be linked to the child's death even though the *not* acting carried double the chance of fatality! Something very similar happened for real in the UK from the late 1990s when flimsy evidence, eventually declared fraudulent by the British Medical Journal (Deer, 2011), that the MMR jab might be a cause of early autism led parents to avoid it, contributing to a significant rise in cases of measles. Uptake dropped from 92% in 1996 to around 85% in 2006, compared with about 94% for other vaccines (McIntyre and Leask, 2008). By 2011 uptake had risen to 90% (HPA, 2011). There has never been any genuine evidence that the MMR jab can cause autism.

Many people are convinced that their 'intuition' tells them reliable truths about the world and about people. Psychologists aren't.

Science – not a subject but a way of thinking

Many students who choose psychology are put off by the idea of 'science' being applied to the study of people. People who are interested in people are not usually terribly interested in laboratory equipment or procedures. However, what we need to be clear about here is that science is not a body of technical knowledge or a boring 'subject' but simply a *way of thinking* that leads us towards testable explanations of what we observe in the world around us. It doesn't deliver the 'truth' but it does provide us with reasonable accounts of what *might* be going on. What's more, *it is a thought system that we all use in our everyday lives.* It is no different from the logic that is used in the following 'everyday' example.

Pause for thought

Imagine that you have a younger brother and that you've been given the task of taking him to the doctor with a rash that he seems to get each week on Monday. The doctor takes one look and asks 'Does he eat broccoli?' 'Yes,' you answer, 'He doesn't like it so he just has to eat it on Sundays when we have a roast dinner with our Gran.' The doctor feels fairly sure that the rash is an allergy. The obvious move now is to banish broccoli from his diet (brother is ecstatic) and watch for the rash. Four weeks later the rash has not re-appeared. The broccoli theory looks good.

Has this 'proved' that broccoli was the problem? Well, no, and here is a point that will be repeated many times in different ways throughout this book. Contrary to popular 'common sense' (and this

is not true just for 'soft' psychology but for all sciences, no matter how hard), *scientific research does not prove theories true*. Listen to scientific experts being interviewed in the media and you will hear them use phrases such as 'all the evidence so far points towards . . .' or 'the evidence is consistent with . . .', no matter how hard the interviewer pushes for a definitive answer to questions such as 'Do power lines cause childhood leukaemia?'. Research supplies *evidence* which might support or contradict a theory. If your brother's rash disappears, then we have *support for* (not proof of) the broccoli allergy theory. We don't have proof because it could have been the herbs that Gran always cooks along with the broccoli that were causing the rash. There is always another possible explanation for findings. However, if the rash remains, then we have, as we shall see, a more definite result that appears to knock out the broccoli theory altogether, though again, there is the outside possibility that your brother is allergic to broccoli *and* to something else that Gran always includes in the Sunday meal. By taking out one item at a time though, and leaving all the others, we could be pretty certain, eventually, what specifically causes the rash.

Never use the term 'prove'

So a scientific test never 'proves' a theory to be true. If ever you are tempted to write 'this proves . . .' always cross out the word 'proves' and use 'supports' instead. The word 'proof' belongs in mathematics, where mathematicians really *do* prove that one side of an equation equals the other, or in detective stories – where the victim's blood on the suspect's shoes is said to 'prove' their guilt. Of course it doesn't. There is always a perhaps stretched but possible innocent explanation of how the blood arrived there ('Oh, he borrowed those shoes last week and I remember he cut himself shaving'). In psychology, as for detective work, if theories are speculative explanations, then 'evidence' can only ever support or challenge, not 'prove' anything. We know that the suspect committed the crime if we see unambiguous footage of the incident. However, we do not now talk of 'evidence' to support a theory since the suspect's

Info Box 1.1 Findings and conclusions

Be careful always to distinguish between 'FINDINGS' and 'CONCLUSIONS'. Findings are what actually occurred in a study – what the results were. Conclusions are what the researcher may conclude as a result of considering findings in the light of background theory. For instance, the fact that identical twins' IQs correlate quite highly is a *finding*. From this finding a researcher might *conclude* that heredity plays a big part in the development of intelligence. This is not the only possible conclusion, however. Since identical twins also share a very similar environment (they even have the same birthday and sex compared with other pairs of siblings), the finding could *also* be taken as evidence for the role of the environment in the development of intelligence. Archer (2000) produced a *finding* that, contrary to expectation and across several countries, females in partnerships used physical aggression slightly more than did their male partners. What we *conclude* from this is *perhaps* that most males, knowing their strength, restrain their impulses. However, we do not *know* this until we conduct further research. The lack of a rash is a *finding*; the assumption that broccoli previously caused it is a *conclusion*. Findings should always be clear, unambiguous and subject to little if any argument. Conclusions, on the other hand, are very often contentious and disputed.

guilt is no longer theory – it is fact (but even then it could have been the suspect's twin!). That a gearbox has been silenced with sawdust is but a theory until we open it up and actually find some – now we have a fact.

Thinking scientifically – we can all do it

I claimed above that people use the logic of scientific thinking in their everyday lives. The difference between ordinary and professional scientific thinking is just a matter of practice and the acquisition of some extra formal concepts and procedures. The study of psychology itself will tell you that almost all children begin to seriously question the world, and to test hypotheses about it, from the age of around six or seven. The logic that you will need to cope with science, and all the concepts of methods and statistics in this book, are in place by age 11. Everything else is just more and more complicated use of the same tools. We use these tools every day of our lives. We used the brother's rash example above to demonstrate this. As a further example suppose you find that every day when you go to your car you find the mirror has been twisted round. You suspect the paper boy. You could of course get up early and observe him but let's suppose this is such a quiet spot that he would just see you and not do it. A simple test would be to cancel the paper one day. If the mirror is then not twisted you can assume *either* it is him *or* a very remarkable coincidence has occurred and the real culprit also happened to have a day off. This is very close to the thinking in significance testing which we will encounter in Chapter 16. In experiments we often have to choose one of two possibilities: did the experiment work or was there just a huge coincidence? Our judgement is based on just how unlikely the coincidence was to occur.

Pause for thought

Most people fairly frequently use the basic logical principles that underlie all scientific thinking, such as the logic of hypothesis testing which we will explore in more detail shortly. They are usually quite capable of generating several basic research designs used in psychology without having received any formal training.

1 To have a go at generating basic research designs, try thinking of ways to test the proposal that 'Heat makes people aggressive.'

2 With student colleagues try to think of ways to gather evidence for this idea. If you do the exercise alone, try it on several different occasions in order to come up with quite different approaches to the test.

3 Some suggestions appear in Table 1.1. (The suggestions that students in workshops produce in answer to this question often predict most of the lecture topics on a first-year course in research methods!)

Suggested designs for testing the theory that heat makes people more aggressive	Methods used (which we will learn more about in Chapters 2–7)
Have people solve difficult problems in a hot room then in a cold room; measure their blood pressure.	Repeated measures experiment; very indirect measure of aggression. (Chapter 3)
Have one group of people solve problems in a hot room and a different group solve them in a cool room. Have them tear up cardboard afterwards and assess aggression from observation.	Between groups (independent samples) experiment; aggression assessed from direct observation of behaviour but coding (see page 141) will be required. (Chapter 3)
Observe amount of horn-hooting by drivers in a city on hot and cold days.	Naturalistic observation. (Chapter 6)
Put people in either a hot or cold room for a while, then interview them using a scale to measure aggression.	Between groups (independent samples) experiment; dependent variable is a measurement by psychological scale. (Chapter 8)
Approach people on hot and cold days, and administer (if they agree) aggression scale.	Between groups quasi-experiment (Chapter 5); aggression is defined as measured on a psychological scale.
Check public records for the number of crimes involving aggression committed in hot and cold seasons in the same city.	Use of archival data, a kind of indirect observation. (Chapter 6)

Table 1.1 Possible ways to test the hypothesis that heat makes people more aggressive.

Beyond common sense – the formal scientific method

The discussion and exercises above were intended to convey the idea that most people use the logical thinking that is needed for scientific investigation every day of their lives. Many people believe they are a long way from scientific thinking but they usually are not. However, it is now time to tackle the other side of the coin – the belief that psychology (and psychological science) is all just 'common sense'. Allport argued that psychological science should have the aim of 'enhancing – above the levels achieved by common sense – our powers of predicting, understanding and controlling human action' (1940: 23).

If we can predict, then we have observed enough to know that what we are observing does not just happen randomly; we have noted a pattern of regularities. For instance we know that broccoli leads to a rash but we may not understand why. Understanding is Allport's next criterion. The final one, *controlling* human action, may sound authoritarian and worrying, which is ironic when you know that Allport was, in the same paragraph as the quotation, arguing *against* authoritarianism in psychological science. By 'control' he was referring to the fact that science is usually put to good purpose. If we can understand and control events, we can also improve people's lives. In the case of psychology, some of the benefits to society might be: improving teaching and learning, reducing antisocial and prejudicial behaviour, operating the most effective and humane forms of management, alleviating people's disturbed behaviour, enhancing human sporting performance, and so on.